

New Ohio and Indiana Records of Aquatic Insects (Ephemeroptera, Plecoptera, Trichoptera, Coleoptera: Elmidae, Diptera: Chironomidae)

MICHAEL J. BOLTON¹, SARAH K. MACY², R. EDWARD DEWALT³, AND LUKE M. JACOBUS⁴

¹Ohio Environmental Protection Agency, Division of Surface Water, 4675 Homer Ohio Lane, Groveport, OH 43125, Michael.Bolton@epa.ohio.gov; ²Formerly with the Ohio Environmental Protection Agency; current e-mail: sarahk5678@gmail.com; ³University of Illinois, Illinois Natural History Survey, 1816 S Oak St., Champaign, IL 61820, dewalt@illinois.edu; ⁴Indiana University–Purdue University Columbus, 4601 Central Avenue, Columbus, IN 47203, lukemjacobus@alumni.purdue.edu.

Abstract: New state records and additional locations for rarely collected species are reported for Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddisflies), Coleoptera: Elmidae (riffle beetles), and Diptera: Chironomidae (chironomids, non-biting midges, midges). These specimen records result primarily from Ohio Environmental Protection Agency biomonitoring of Ohio streams and from records found in the Purdue University Entomological Research Collection and the Illinois Natural History Survey Insect Collection; a few records were derived from material housed in two other collections. New state records for Ohio consist of the mayflies *Acentrella rallatoma* Burian & Myers, *Acerpenna pygmaea* (Hagen), *Anafroptilum album* (McDunnough), *Anafroptilum minor* group species 1, *Anafroptilum minor* group species 2, *Anafroptilum victoriae* (McDunnough), *Heterocloeon (Jubilatum)* species B McCafferty et al., *Heterocloeon (Jubilatum)* species D McCafferty et al., *Labiobaetis longipalpus* (Moriyama & McCafferty), *Plauditus punctiventris* (McDunnough), *Ephemerella guttulata* Pictet, *Habrophlebia vibrans* Needham, and *Anthopotamus verticis* (Say); the stonefly *Isoperla frisoni* Illies; the caddisflies *Brachycentrus nigrosoma* (Banks), *Homoplectra doringa* (Milne), *Ceraclea nepha* (Ross), and *Fabria inornata* (Banks); the riffle beetle *Oulimnius nitidulus* (LeConte); and the chironomids *Cricotopus (Isocladius)* sp. “Ozarks” Epler, *Cricotopus (Isocladius)* sp. “Santa Fe” Epler, *Fittkauimyia* sp. [probably *F. sarta* (Roback)], *Parakiefferiella* sp. F Epler, and *Saetheria hirta* Sæther. A previous report of the mayfly *Macdunnoa persimplex* (McDunnough) from the Ohio River, adjacent to Ohio, is substantiated with record data. The caddisfly *Goerita betteni* Ross is confirmed in Ohio. New state records for Indiana consist of the mayflies *Heterocloeon (Jubilatum)* species D McCafferty et al. and *Leucrocota walshi* (McDunnough) and the chironomids *Cricotopus (Isocladius)* sp. “Ozarks” and *Fittkauimyia* sp. [probably *F. sarta* (Roback)]. Recent Indiana records of the mayflies *Homoeoneuria ammophila* (Spieth) and *Pentagenia vittigera* (Walsh) are also included because these species are rarely collected and most existing records are old. These records represent significant range extensions north for *Cricotopus (Isocladius)* sp. “Santa Fe” Epler, *Fittkauimyia* sp. [probably *F. sarta* (Roback)], *Parakiefferiella* sp. F Epler, and *Saetheria hirta* Sæther.

Keywords: Ohio, Indiana, state records, Ephemeroptera, Plecoptera, Trichoptera, Coleoptera, Elmidae, Diptera, Chironomidae

Introduction

The aquatic insects of Ohio and Indiana are comparatively well known. For Ohio, many treatments have been published over the past two decades, including checklists, analyses of species richness patterns, taxonomic treatments, distributional atlases, and compendia of other biological information. Bolton (2010) summarized published records of Ohio Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddisflies), and Coleoptera (beetles), along with documenting new state records known at that time. Since then, Armitage et al. (2011) published a checklist and distributional atlas of Ohio caddisflies; Bolton (2012) listed all known chironomid taxa from Ohio and included supplemental identification keys; DeWalt et al. (2012) published an analysis of Ohio’s stonefly diversity; and DeWalt et al. (2016) published an Ohio stonefly atlas. In addition to the orders mentioned above, Glotzhober and McShaffrey (2002) provided a review of Ohio Odonata (dragonflies and damselflies) including identification keys, a synopsis, and an atlas.

A comprehensive list of Indiana mayfly records was presented in Randolph and McCafferty (1998). Additional records can be found in McCafferty et al. (2004), Jacobus and McCafferty (2006), McCafferty (2009), and DeWalt et al. (2016). The most recent comprehensive list of Indiana mayflies was by Jacobus (2016). Bednarik and McCafferty (1977) provided a comprehensive list of Indiana stoneflies. That list was updated in Grubbs (2004) and DeWalt and Grubbs (2011). Waltz and

McCafferty (1983) published the first comprehensive list of Indiana caddisflies. DeWalt et al. (2016) added a few more state records. Rasmussen and Morse (2018) should be consulted for an up-to-date list of state records for each species of caddisfly in North America. A few chironomid records can be found in Townes (1945), Stahl (1959, 1966, 1998), and Roback (1971). There is no comprehensive list of Indiana chironomids.

Despite the relatively intense study of Ohio's and Indiana's aquatic insect fauna, some species have not been noted for many years, and additional species continue to be added to the lists of species known from the states. One important source of aquatic insect specimens comes from the Ohio Environmental Protection Agency (Ohio EPA) that conducts biological and water quality studies of Ohio streams to ascertain the condition of the aquatic resource. Because of this sampling and regional surveys conducted by RED, LMJ, and the biological surveys of Indiana streams by the Indiana Department of Environmental Management, species of aquatic insects new to Ohio and Indiana are occasionally discovered. This paper documents several new state records and additional records for recently found species of mayflies, stoneflies, caddisflies, riffle beetles, and chironomids.

Methods

The Ohio EPA collected macroinvertebrate samples using standard methods (Ohio EPA 2015). A qualitative inventory of all observed macroinvertebrate taxa from all available stream habitats was conducted at each site. These samples were preserved in the field with 95% ethanol. Larger stream sites were also sampled with artificial substrates, the entire sampling device being preserved in the field in 10% formalin. Macroinvertebrates removed from these samplers were later transferred to 70% ethanol. Abbreviations used in this paper are: adj. = adjacent, CR = county route, DA = drainage area (mi²), dst. = downstream, RM = the river mile of the site measured from the mouth of the stream, SR = state route, TR = township route, US = U.S. route, and ust. = upstream. Most Ohio specimens represented by the records reported in this paper are housed in the Ohio EPA collection, Columbus, Ohio, unless otherwise noted. Other specimens were studied from the Purdue Entomological Research Collection, Purdue University, West Lafayette, Indiana [PERC]; the Illinois Natural History Survey, Champaign, Illinois [INHS]; the personal collection of Luke M. Jacobus at Indiana University–Purdue University Columbus, Columbus, Indiana [LMJ]; the Monte L. Bean Museum at Brigham Young University, Provo, Utah [BYU]; the Indiana Department of Environmental Management, Indianapolis, Indiana [IDEM]; and the insect collection at Florida Agricultural & Mechanical University, Tallahassee, Florida [FAMU].

New data and remarks are presented below for mayflies, stoneflies, caddisflies, beetles, and true flies. Orders are presented in this sequence, with families, genera and species presented alphabetically under their respective order. Records refer to larvae, unless otherwise noted.

Species Accounts

Ephemeroptera: Baetidae

Acentrella rallatoma Burian & Myers.— Figures 1 & 2. These new records from Ohio are from small streams in the unglaciated Western Allegheny Plateau ecoregion with drainage areas ranging from 3.3 to 10.9 mi². This is one of three species of *Acentrella* in North America that have caudal filaments with many alternating dark and light bands. This species can be separated from the other species by having the combination of: 1) the abdominal terga with rather uniform brown coloration with an anterior median pale spot, 2) mandibles with outer incisors fused into a scraping blade, and 3) the absence of brown coloration in the gills (Burian and Myers 2011, Webb and Burian 2017). We saw some color variation among the materials examined. For example, the specimen from Dutch Run (Fig. 1) resembles the color pattern of Fig. 5 in Burian and Myers (2011), and the specimen from West Branch Shade River (Fig. 2) resembles Fig. 2 in Webb and Burian (2017).

NEW OHIO RECORDS: **Coshocton County:** Darling Run, at lane (TR 1240) off TR 340 at Nellie Cemetery, RM 0.1, DA 3.3 mi², 40.34363, -82.04922, 01-VII-2010, A.A. Dripps [PERC]; Dutch Run, at TR 344/TR 338, RM 0.8, DA 5.4 mi², 40.366959, -82.096562, 01-VII-2010, A.A. Dripps [PERC]; **Meigs County:** tributary to West Branch Shade River (at RM 16.35), at SR 681, RM 0.1, DA 8.3 mi², 39.169967, -82.079777, 13-VII-2015, L.B. Hughes; West Branch Shade River, at SR 681 W of Burlingham, RM 16.5, DA 10.9 mi², 39.170327, -82.081507, 13-VII-2015, L.B. Hughes [PERC].

Acerpenna pygmaea (Hagen).— Randolph and McCafferty (1998) listed *A. pygmaea* from Ohio, and they indicated a report from Allen County on their map (Fig. 16 in Randolph and McCafferty 1998), but they provided no substantiating specimen



Figure 1. *Acentrella rallatoma* from Dutch Run, dorsal and ventral view.



Figure 2. *Acentrella rallatoma* from West Branch Shade River.

data. This species is widely distributed and common in Ohio with 1219 statewide records from streams with drainage areas ranging from 1.8 to 5562 mi² (median of 52 mi²; Ohio EPA, unpublished). Representative county records (including Allen County) are provided here to establish its presence formally with record data (McCafferty 2000) and to document its widespread distribution in Ohio.

NEW OHIO RECORDS: **Adams County:** Ohio Brush Creek, at end of TR. 84, RM 15.2, DA 371 mi², 38.8267, -83.4281, 26-VIII-1992, Ohio EPA Biologist; **Allen County:** Ottawa River, ust. Lima at Thayer Road, RM 45.97, DA 99 mi², 40.7656, -84.0131, 10-IX-1991, J. Freda; **Ashland County:** Katotawa Creek, at Montgomery TR 1275, RM 3.49, DA 9.1 mi², 40.8878, -82.2294, 3-VII-2007, C.E. McKnight; **Ashtabula County:** Rock Creek, at Cemetery Bridge adj. SR 166, RM 0.95, DA 70 mi², 41.6606, -80.8656, 29-VIII-1995, M. Knapp; **Auglaize County:** Pusheta Creek, Hardin Pike, RM 3.0, DA 19 mi², 40.5389, -84.2017, 28-VIII-2000, E.L. Moore; **Brown County:** Sterling Run, Sterling Road Southern Ford, RM 0.58, DA 29.6 mi², 38.9681, -83.9203, 19-VIII-1997, M.J. Bolton; **Butler County:** Sevenmile Creek, Taylor School Road, RM 1.32, DA 136 mi², 39.4806, -84.5625, 17-IX-1991, M.J. Bolton; **Champaign County:** Proctor Run, McMahill Road, RM 1.6, DA 9.9 mi², 40.158959, -83.506525, 14-VIII-1992, J. DeShon; **Clark County:** Little Miami River, near Clifton Road, RM 101.3, DA 9.2 mi², 39.8231, -83.6611, 31-VIII-1993, M.J. Bolton; **Clermont County:** Stonelick Creek, US 50, RM 1, DA 75 mi², 39.1225, -84.1992, 1-IX-1993, J. Freda; **Clinton County:** West Branch Rattlesnake Creek, SR 729, RM 4.3, DA 15.8 mi², 39.5317, -83.6192, 8-IX-1997, E.L. Moore; **Crawford County:** Olentangy River, dst. Galion at Taylor Road, RM 84.1, DA 28 mi², 40.723358, -82.834604, 23-VIII-1994, M. Knapp; **Cuyahoga County:** East Branch Rocky River, near North Royalton at Bennett Road, RM 15.15, DA 40 mi², 41.2953, -81.7594, 2-IX-1992, J. DeShon; **Darke County:** Painter Creek, Littles Road, RM 17.87, DA 2.1 mi², 39.9994, -84.5769, 10-VIII-1999, M. Knapp; **Defiance County:** St. Joseph River, County Line Road, RM 47.3, DA 578 mi², 41.4222, -84.7739, 1-X-1992, C.E. McKnight; **Delaware County:** Olentangy River, Hyatts Road, RM 19.42, DA 460 mi², 40.21497, -83.06041, 5-IX-1991, Ohio EPA Biologist; **Erie County:** Huron River, US 250, RM 12.3, DA 371 mi², 41.3008, -82.6083, 30-VIII-1993, C.E. McKnight; **Fairfield County:** Salt Creek, ust. Tarlton at Thomas Hill Road, RM 41.09, DA 10.4 mi², 39.5667, -82.7828, 18-IX-1992, M.J. Bolton; **Fayette County:** Paint Creek, New Holland Road, RM 75.33, DA 58 mi², 39.5753, -83.4758, 3-IX-1997, E.L. Moore; **Franklin County:** Big Walnut Creek, N Hamilton Road, RM 27.11, DA 239 mi², 39.9969, -82.8683, 3-IX-1991, M.J. Bolton; **Fulton County:** Bad Creek, CR D, RM 10.46, DA 44 mi², 41.5303833, -83.980964, 2-IX-1997, M.J. Bolton; **Geauga County:** Chagrin River, Sperry Road, RM 40.03, DA 29 mi², 41.490652, -81.294929, 3-X-2003, E.L. Moore; **Greene County :** South Fork Massies Creek, end of Farm Lane, RM 1.1, DA 19.2 mi², 39.738702, -83.785606, 11-VIII-1993, M.J. Bolton; **Hamilton County:** Little Miami River, West Loveland Road, RM 23.9, DA 1145 mi², 39.2689, -84.2608, 2-IX-1993, J. DeShon; **Hancock County:** Blanchard River, ust. Findlay, adj. TR 208, RM 61.9, DA 238 mi², 41.0349, -83.5922, 3-IX-1991, C.E. McKnight; **Hardin County:** North Fork Great Miami River, CR 65, RM 8.3, DA 10.5 mi², 40.5386, -83.7775, 1-IX-1994, J. DeShon; **Henry County:** Bad Creek, CR T, RM 2.47, DA 58 mi², 41.443473, -83.95397, 2-IX-1997, M.J. Bolton; **Highland County:** East Fork White Oak Creek, Edwards Road, RM 14.26, DA 26 mi², 39.0778, -83.7389, 19-VIII-1997, M.J. Bolton; **Hocking County:** Tributary to Fivemile Creek (at RM 3.44), N of Union Furnace, RM 0.1, DA 4.7 mi², 39.4694, -82.3619, 7-VII-2004,

M.J. Bolton; **Holmes County:** Odell Lake Outlet, SR 179, RM 0.59, DA 31.6 mi², 40.657, -82.1352, 4-IX-2007, M.J. Bolton; **Huron County:** Slate Run, Townline Road, RM 4.1, DA 38.4 mi², 41.1858, -82.7383, 9-IX-1998, M.J. Bolton; **Lake County:** Big Creek, Fay Road, RM 2.47, DA 36 mi², 41.6875, -81.2231, 24-IX-2003, J. Freda; **Lawrence County:** Sharps Creek, near mouth, RM 0.2, DA 4.6 mi², 38.614549, -82.495453, 13-VII-2016, E.L. Moore; **Licking County:** South Fork Licking River, near SR 360/SR 79, RM 15.75, DA 62 mi², 39.9274, -82.5221, 13-IX-1993, M. Knapp; **Logan County:** Macochee Creek, at West Liberty at mouth, RM 0.1, DA 19.1 mi², 40.2489, -83.7533, 20-IX-1991, Ohio EPA Biologist; **Lorain County:** West Branch Black River, SR 511 (Upper Crossing), RM 41.67, DA 16 mi², 41.13342, -82.3067, 25-VIII-1992, C.E. McKnight; **Lucas County:** Tenmile Creek, Sylvania Avenue, RM 4.12, DA 69 mi², 41.6883, -83.735, 29-IX-1992, J. Freda; **Madison County:** Little Darby Creek, Rosedale-Plain City Road, RM 24.46, DA 78 mi², 40.073361, -83.40272, 5-IX-1991, J. Bohné; **Marion County:** Little Scioto River, Hillman Ford Road, RM 9.24, DA 73 mi², 40.6267, -83.1736, 5-IX-1991, Ohio EPA Biologist; **Medina County:** East Branch Rocky River, Harter Road, RM 26.63, DA 14.3 mi², 41.2100583, -81.6847444, 1-IX-1992, J. DeShon; **Meigs County:** Fivemile Run, Hills Road (TR 5), RM 2.48, DA 1.8 mi², 39.1803, -82.191, 20-VIII-2009, J. Freda; **Mercer County:** Twelvemile Creek, Celina-Mendon Road, RM 2.31, DA 35.9 mi², 40.6519, -84.5183, 21-VIII-1996, J. Freda; **Miami County:** Lost Creek, SR 202, RM 2.6, DA 61 mi², 39.9992, -84.1667, 30-VIII-1994, M.J. Bolton; **Montgomery County:** Toms Run, near mouth adj. Anthony Road, RM 0.1, DA 25.7 mi², 39.6636, -84.4453, 23-VI-1993, J. DeShon; **Morgan County:** Little Wolf Creek, dst. CR 13, RM 1, DA 10.6 mi², 39.566799, -81.872596, 10-IX-2013, E.L. Moore; **Morrow County:** Flat Run, West Canaan Road, RM 0.55, DA 42.6 mi², 40.6266, -82.952556, 26-VIII-1994, M. Knapp; **Muskingum County:** Little Duncan Run, Duncan Run Road, RM 0.06, DA 2.8 mi², 39.8505173, -81.9170763, 8-VII-2008, E.L. Moore; **Noble County:** Middle Fork Duck Creek, SR 564, RM 9.74, DA 9.5 mi², 39.704, -81.4516, 25-VII-2000, E.L. Moore; **Ottawa County:** Portage River, Hyde Run mixing zone, RM 16.53, DA 496 mi², 41.4917, -83.2111, 8-IX-1994, J. DeShon; **Paulding County:** Prairie Creek, Paulding/Van Wert county line, RM 18.04, DA 15 mi², 40.9897, -84.6042, 23-IX-1996, M.J. Bolton; **Pickaway County:** Big Darby Creek, SR 316, RM 13.36, DA 534 mi², 39.7008, -83.1097, 30-IX-1992, M.J. Bolton; **Pike County:** Haw Fork, adj. Turkey Run Road, RM 0.4, DA 8.4 mi², 39.151678, -83.099138, 29-VI-2011, E.L. Moore; **Portage County:** Cuyahoga River, ust. Mantua at Pioneer Trail, RM 71.7, DA 157 mi², 41.3006, -81.2031, 28-VIII-1991, C.E. McKnight; **Preble County:** Sevenmile Creek, US 127, RM 24.1, DA 32 mi², 39.7192, -84.6264, 16-IX-1991, M.J. Bolton; **Putnam County:** Sugar Creek, CR R, RM 4.93, DA 55 mi², 40.9189, -84.1719, 16-IX-1996, M.J. Bolton; **Richland County:** Clear Fork Mohican River, Kochheiser Road, RM 24.39, DA 60 mi², 40.6514, -82.5494, 1-IX-1998, E.L. Moore; **Ross County:** Paint Creek, ust. SR 772, RM 5, DA 1137 mi², 39.3097, -82.9906, 22-IX-1992, M.J. Bolton; **Sandusky County:** Portage River, dst. US 20, RM 28.04, DA 428 mi², 41.4492, -83.3592, 7-IX-1994, J. DeShon; **Seneca County:** Rock Creek, Main Street, RM 1.05, DA 34.5 mi², 41.112355, -83.163819, 9-VII-1992, M.J. Bolton; **Shelby County:** Loramie Creek, Lehman Road, RM 3.75, DA 247 mi², 40.2286, -84.2564, 30-VIII-1994, M. Knapp; **Trumbull County:** Grand River, at Hyde Road, RM 83.45, DA 85.4 mi², 41.4114, -80.9142, 30-VIII-1995, M.J. Bolton; **Union County:** Treacle Creek, Winget Road, RM 0.78, DA 36 mi², 40.13816, -83.452423, 19-VIII-1992, C.E. McKnight; **Van Wert County:** Jennings Creek, ust. Delphos at CR 244, RM 7.57, DA 40 mi², 40.8306, -84.3542, 21-VIII-1996, J. DeShon; **Warren County:** Little Miami River, Kings Mills Road, RM 30.72, DA 1054 mi², 39.3519139, -84.2426472, 1-IX-1993, J. DeShon; **Washington County:** Turkeyhen Run, CR 126 (TR 557), RM 1.2, DA 3.3 mi², 39.415943, -81.57151, 26-VI-2013, E.L. Moore; **Wayne County:** Killbuck Creek, Old Mansfield Road, RM 51.6, DA 128 mi², 40.8011, -81.9758, 7-IX-1993, J. Freda; **Williams County:** St. Joseph River, dst. Edgerton Metals, RM 50.8, DA 553 mi², 41.4447, -84.7461, 1-X-1992, C.E. McKnight; **Wood County:** North Branch Portage River, SR 199, RM 4.94, DA 49 mi², 41.4014, -83.5219, 7-IX-1994, J. DeShon; **Wyandot County:** Tymochtee Creek, US 23, RM 8.6, DA 229 mi², 40.917255, -83.354623, 18-VIII-1999, J. DeShon.

***Anafroptilum album* (McDunnough).**— This species has a wide distribution in North America (Randolph and McCafferty 1998, Mayfly Central 2018). These specimens were collected from the spring-fed streams located in Cedar Bog State Nature Preserve. Cedar Bog is an alkaline fen which is formed by numerous springs. It is known to support many rare plants and animals, including the only known Ohio location for the chironomids *Macropelopia* (*Bethbilbeckia*) *floridensis* (Fittkau & Murray), *Radotanypus florens* (Johannsen) (possibly an undescribed species), and *Zavrelimyia* (*Paramerina*) *smithae* (Sublette) (Bolton 1992).

NEW OHIO RECORDS: Champaign County: Cedar Run, NE of Tremont City at Dallas Road, RM 1.95, DA 1.0 mi², 40.04864, -83.79751, 19-V-2018, S.K. Macy; West Branch Cedar Run, adj. Cedar Bog State Nature Preserve boardwalk, RM 0.3, DA 0.3 mi², 40.0582, -83.7968, 19-V-2018, S.K. Macy.

***Anafroptilum minor* group species 1.**— Figure 3. These new records from Ohio were primarily from streams in the unglaciated Western Allegheny Plateau ecoregion with drainage areas ranging from 1.9 to 586 mi². The *A. minor* group was once part of the genus *Centroptilum*, but Jacobus and Wiersema (2014) moved all North American *Centroptilum* to *Anafroptilum* or *Neocloeon*. Both *A. minor* group species are characterized by 1) the mesonotum having a pair of conical dorsal posterior projections (*Anafroptilum* sp. 1 may also have a dorsal longitudinal ridge anterior to the dorsal dark spot), 2) middle abdominal sterna

that are characterized by heavy darkening on the anterior margin (sometimes with an interruption in the middle), and 3) paired submedial dark dashes adjacent to the posterior margin. However, due to distinct and consistent color pattern differences among our specimens and a specimen from New Hampshire (as *Centropetium minor*; Discover Life 2018), we list two provisional *A. minor* group species. The main color pattern differences between species 1 and 2 are that species 1 has dark abdominal bands that occupy the posterior fourth to half of several terga (at least 2, 4, 6–9) and sterna (at least 4–9; Fig. 3), while species 2 lacks these (Fig. 4). Also, the darkened segments of the caudal filament are more distal in species 1, as compared to species 2. An obligately parthenogenetic lineage of *A. minor* was reported by Webb et al. (2012: Text S1: 14) and Jacobus and Wiersma (2014) as a possible new species in this group. The *A. minor* group is atypical of *Anafroptilum* (Jacobus and Wiersma 2014). It eventually may prove to be a separate genus, but more data and analyses of related taxa are needed.



Figure 3. *Anafroptilum minor* group species 1 from Kirby Run, dorsal and ventral view.



Figure 4. *Anafroptilum minor* group species 2 from Lower Twin Creek, dorsal and ventral view.

NEW OHIO RECORDS: **Athens County:** Middle Branch Shade River, dst. Pratts Fork at TR 227, RM 14.80, DA 40.10 mi², 39.196476, -81.974262, 8-IX-2015, S.K. Macy; **Gallia County:** Kyger Creek, ust. Kyger at SR 554 across from Van Zant Road, RM 8.42, DA 11.50 mi², 38.982484, -82.16425, 7-VII-2015, A.A. Dripps; Campaign Creek, dst. White Oak Creek, adj. Campaign Road, RM 11.50, DA 21.70 mi², 38.93474, -82.24848, 18-VIII-2015 A.A. Dripps; Raccoon Creek at Adamsville at US 35, RM 29.20, DA 586.0 mi², 38.8736, -82.3561, 8-IX-2016, L.B. Hughes; Indian Guyan Creek, Mercerville Road, RM 29.05, DA 5.2 mi², 38.660882, -82.291173, 6-IX-2016, E.L. Moore; **Geauga County:** West Branch Cuyahoga River, Aquilla Road, RM 5.6, DA 25.4, 41.4878, -81.1743, 27-VIII-2018, C.E. McKnight; West Branch Cuyahoga River, Hotchkiss Road, RM 1.7, DA 34.4, 41.458989, -81.161666, 27-VIII-2018, C.E. McKnight; **Guernsey County:** Indian Camp Run, NW of town of Indian Camp at SR 658, RM 3.90, DA 11.20 mi², 40.105, -81.6547, 9-VII-2014, L.B. Hughes; Clear Fork, Rye Lane S of Birmingham at TR 5880, RM 1.83, DA 13.70 mi², 40.1472, -81.4542, 17-VII-2014, L.B. Hughes; Rocky Fork, W of Birmingham at Rocky Fork Road, RM 5.56, DA 12.20 mi², 40.1747, -81.4947, 17-VII-2014, L.B. Hughes; Marlatt Run (Tributary to Wills Creek at RM 24.0), at Marlatt Run Road, RM 0.40, DA 7.10 mi², 40.210548, -81.664224, 6-VIII-2014, L.B. Hughes; Yoker Creek, NE of Cumberland at North Iowa Road, RM 0.34, DA 23.10 mi², 39.8714, -81.6258, 18-VIII-2014, L.B. Hughes; Buffalo Creek, at Fairview at SR 146, RM 0.08, DA 49.90 mi², 39.9028, -81.5506, 19-VIII-2014, L.B. Hughes, [PERC]; Seneca Fork, at Buffalo at CR 25, RM 2.07, DA 150.0 mi², 39.9125, -81.5172, 3-IX-2014, L.B. Hughes; Birds Run, at town of Birds Run at SR 541, RM 0.17, DA 31.10 mi², 40.1692, -81.6481, 12-IX-2014, L.B. Hughes; **Harrison County:** Kirby Run, at Scio Road., RM 0.7, DA 3.4 mi², 40.4317, -81.085, 20-IX-2016, L.B. Hughes; **Lawrence County:** Symmes Creek, at Waterloo-Mt. Vernon Rd., RM 38.7, DA 201.9 mi², 38.730818, -82.492679, E.L. Moore; **Meigs County:** Groundhog Creek, at Sellers Ridge Road, RM 2.30, DA 6.20 mi², 38.983708, -81.801824, 20-VII-2015, L.B. Hughes; Shade River, near Keno, adj. TR 114, RM 5.84, DA 215.0 mi², 39.094478, -81.853157, 15-IX-2015, L.B. Hughes, East Branch Shade River, at SR 248 E of Chester, RM 0.87,

DA 45.0 mi², 39.103201, -81.86216, 15-IX-2015, L.B. Hughes; Shade River, at Chester at SR 248, RM 17.13, DA 131.0 mi², 39.087339, -81.92518, 15-IX-2015, L.B. Hughes; West Branch Shade River, at Clark-Midkiff Road, RM 7.80, DA 36.0 mi², 39.135599, -81.997241, 22-IX-2015, L.B. Hughes; **Monroe County:** Rich Fork, adj. Edwina Road, RM 4.00, DA 5.20 mi², 39.7258, -81.1928, 22-VII-2015, L.B. Hughes; Walnutcamp Run, at TR 503 ford, RM 0.44, DA 2.30 mi², 39.6475, -81.0156, 15-VII-2015, S.K. Macy; Woods Run, at Benwood at Benwood Road, RM 0.12, DA 2.0 mi², 39.685388, -81.001193, 14-VII-2015, S.K. Macy; Rias Run, NE of Marr, near mouth adj. CR 13, RM 0.20, DA 2.30 mi², 39.6419, -81.2125, 14-VII-2015, M.J.

Bolton; Dismal Creek, E of Antioch at TR 470, RM 1.75, DA 5.50 mi², 39.6664, -81.0489, 20-VIII-2015, L.B. Hughes; Witten Fork, dst. Alum Run at ford, RM 6.20, DA 18.20 mi², 39.6586, -81.01, 19-VIII-2015, L.B. Hughes; Witten Fork, near Benwood, adj. SR 255, RM 9.00, DA 5.30 mi², 39.6889, -81.0061, 19-VIII-2015, L.B. Hughes; Cranenest Fork, ust. Laings at CR 28, RM 10.45, DA 10.10 mi², 39.7239, -81.0139, 19-VIII-2015, L.B. Hughes; Millers Fork, N of Antioch, adj. TR 457, RM 3.40, DA 3.30 mi², 39.6944, -81.0614, 19-VIII-2015, L.B. Hughes; Clear Fork, near mouth at SR 26, RM 0.29, DA 48.80 mi², 39.6025, -81.1628, 9-IX-2015, L.B. Hughes; Little Muskingum River, ust. Clear Fork at Knowlton Bridge, RM 37.50, DA 149.0 mi², 39.5936, -81.1547, 9-IX-2015, L.B. Hughes; Little Muskingum River, just dst. Biglick River or ust. at Greenbriar Rd., RM 42.50, DA 129.0 mi², 39.6136, -81.11, 9-IX-2015, L.B. Hughes; Little Muskingum River, TR 1003/1004, SW of Antioch, RM 48.80, DA 66.70 mi², 39.646212, -81.083634, 9-IX-2015, L.B. Hughes; Little Muskingum River, at CR 47 (Foraker Covered Bridge), RM 51.80, DA 61.0 mi², 39.6553, -81.12, 8-IX-2015, L.B. Hughes; Little Muskingum River, at TR 42 Stonehouse Rd. dst. Rich Fork, RM 57.70, DA 48.90 mi², 39.693231, -81.139219, 8-IX-2015, L.B. Hughes; **Noble County:** Buffalo Creek, NW of Sarahsville at Old Infirmary Road (CR 21), RM 9.20, DA 21.20 mi², 39.823781, -81.487171, 29-VIII-2014, L.B. Hughes; North Fork Buffalo Creek, NW of Sarahsville at Halley Ridge Road, RM 0.73, DA 6.7 mi², 39.841262, -81.504906, 26-VI-2014, L.B. Hughes; **Scioto County:** Scioto River, at Rushtown, just dst. Scioto Brush Creek, RM 9.10, DA 6471.0 mi², 38.8333, -83.0183, 8-IX-2016, S.K. Macy; **Vinton County:** Raccoon Creek, dst. Sandy Run (Lake Hope) at CR 3, RM 92.30, DA 134.0 mi², 39.3172, -82.3514, 16-VIII-2016, L.B. Hughes; Hewett Fork, SE of Lake Hope at mouth, RM 0.01, DA 40.50, 39.304465, -82.322649, 16-VIII-2016, L.B. Hughes; **Washington County:** Bear Run, SW of Dart at mouth at Martin Road, RM 0.10, DA 3.90 mi², 39.4731, -81.2822, 23-VII-2015, L.B. Hughes; Sycamore Fork, at town of Fifteen at mouth, RM 0.10, DA 4.50 mi², 39.5306, -81.2811, 23-VII-2015, L.B. Hughes; Fifteenmile Creek, at Heslop at TR 12, RM 3.85, DA 11.0 mi², 39.5164, -81.2847, 23-VII-2015, L.B. Hughes; Goss Fork, at mouth adj. TR 24, RM 0.10, DA 4.10 mi², 39.4989, -81.2981, 23-VII-2015, L.B. Hughes; Moss Run, SW of town of Moss Run at TR 584 (Alexander Road), RM 0.07, DA 4.60 mi², 39.461576, -81.32445, 23-VII-2015, L.B. Hughes; Wingett Run, near town of Wingett at SR 26, RM 0.05, DA 5.30 mi², 39.5386, -81.24, 28-VII-2015, L.B. Hughes; Archers Fork, ust. Cady Run at TR 36, RM 4.96, DA 9.20 mi², 39.483546, -81.205884, 10-VIII-2015, L.B. Hughes; Little Muskingum River, SW of Bloomfield at CR 406 (Rinard), RM 25.75, DA 218.0 mi², 39.5369, -81.2228, 10-IX-2015, L.B. Hughes; Little Muskingum River, at TR 34 (Hune Bridge), RM 21.23, DA 229.0 mi², 39.510461, -81.250285, 16-IX-2015, L.B. Hughes; Little Muskingum River, at Bloomfield at SR 260, RM 30.13, DA 210.0 mi², 39.5631, -81.2039, 16-IX-2015, L.B. Hughes; West Branch Little Hocking River, at CR 248 (Ross Road), RM 2.87, DA 36.20 mi², 39.289612, -81.74608, 15-IX-2015, L.B. Hughes; Little Muskingum River, at Dart, dst. Archers Fork at ford, RM 17.20, DA 253.0 mi², 39.483952, -81.271454, 17-IX-2015, L.B. Hughes; Little Muskingum River, at Sitka at TR 19, RM 9.50, DA 287.0 mi², 39.4481, -81.3364, 23-IX-2015, L.B. Hughes; Little Muskingum River, S of Rinard Mills at TR 403, RM 34.64, DA 201.0 mi², 39.5669, -81.1533, 16-IX-2015, L.B. Hughes; Sycamore Fork, adj. TR 363, RM 0.90, DA 2.90 mi², 39.5425, -81.2847, 12-VIII-2015, L.B. Hughes.

Anafroptilum minor group sp. 2.— Figure 4. This specimen was collected from southern Ohio from a small stream in the unglaciated Western Allegheny Plateau ecoregion. See discussion under previous species for more details about its provisional species status.

NEW OHIO RECORD: Adams County: Lower Twin Creek, NW of Buena Vista, adj. Lower Twin Creek Road, RM 2.1, DA 14.1 mi², 38.648128, -83.273903, 12-VII-2016, M.J. Bolton.

Anafroptilum victoriae (McDunnough).— This specimen was collected from a small stream in glaciated northeast Ohio. It was identified with the key in Klubertanz (2016).

NEW OHIO RECORD: Portage County: tributary to Cuyahoga River (at RM 69.43), at Canada Road, RM 0.2, DA 3.8 mi², 41.2753, -81.2215, 13-VII-2018, C.E. McKnight.

Heterocloeon (Jubilatum) species B McCafferty et al. 2017.— This widespread eastern North American species was illustrated and keyed by McCafferty et al. (2017) in a work about the U.S.A. Southeast. The species likely has been confused with *Heterocloeon amplum* (Traver) in the past, but it is distinguished from *H. amplum* by having a secondary row of minute denticles or bumps on the tarsal claw. This Ohio record is from a first-order headwater stream in the unglaciated Western Allegheny Plateau ecoregion. It was found with several taxa typical of coldwater ecosystems, including the mayflies *Ameletus* sp. (Ameletidae) and *Epeorus* sp. (Heptageniidae); the stoneflies *Amphinemura* sp. (Nemouridae), *Leuctra* sp. (Leuctridae), *Diploperla robusta* Stark & Gaufin (Perlodidae), and *Sweltsa* sp. (Chloroperlidae); the fishfly *Nigronia fasciata* (Walker) (Megaloptera: Corydalidae); the caddisflies *Diplectrona modesta* Banks (Hydropsychidae), *Rhyacophila* sp. (*R. fenestra* Ross or *R. ledra* Ross) (Rhyacophilidae), *Rhyacophila invaria* complex (Rhyacophilidae), *Lepidostoma* sp. (Lepidostomatidae), and *Molanna* sp. (Molannidae); and the true flies *Prosimulium* sp. (Simuliidae), *Trissopelopia ogemawi* Roback (Chironomidae), *Diamesa* sp. (Chironomidae), *Heterotrissocladius marcidus* Sæther (Chironomidae), and *Polypedilum albicorne* (Meigen) (Chironomidae).

NEW OHIO RECORD: Hocking County: tributary to Pine Creek (at RM 8.67), within Crane Hollow State Nature Preserve, RM 2.75, DA 0.18 mi², 39.49208, -82.58143, 3-IV-2016, L.B. Hughes and S.K. Macy.

Heterocloeon (Jubilatum) species D McCafferty et al. 2017.— This is another species illustrated and keyed by McCafferty et al. (2017), who reported it from Ohio and Indiana, but provided no record data. This species is very closely related to *H. amplum*, but larvae have a median filament comprised of more segments (McCafferty et al. 2017), and adults may be colored differently (L.M. Jacobus, unpublished). Based on our data and field observations, *Heterocloeon* sp. D may be more typically found in headwater streams (and possibly waterfalls) than *H. amplum*; it also may be associated with limestone streams and karst ecosystems (L.M. Jacobus, unpublished). The Ohio specimens were collected from a first-order headwater stream in the Interior Plateau ecoregion with a drainage area of 0.1 mi². Associated coldwater taxa in Ohio included the mayfly *Ameletus* sp.; the stoneflies *Amphinemura* sp. and *Leuctra* sp.; and the caddisflies *Homoplectra doringa* (Milne) (Hydropsychidae) and *Rhyacophila* sp. (*R. fenestra* or *R. ledra*).

NEW OHIO RECORD: Hamilton County: tributary to Great Miami River (at RM 19.60), at Glen Oak Nature Preserve, RM 0.90, DA 0.1 mi², 39.25041, -84.68828, 07-V-2014, M.J. Bolton and S.K. Macy [PERC].

NEW INDIANA RECORDS: Monroe Co., tributary to Clear Creek at Cedar Bluff Road, 39.041626, -86.557226, 12-IV-2013, adults emerged in lab until 13-V-2013, L.A. Contreras Cuervo, L.M. Jacobus [LMJ]. **Jefferson Co.,** Clifty Creek below Falls, Madison, Indiana, 22-IV-1949, W.E. Ricker, PU-ACC-1502, eight larvae [PERC].

Labiobaetis longipalpus (Moriyama & McCafferty).— This species was illustrated and keyed in Moriyama and McCafferty (1979b) and McCafferty and Waltz (1995). It has been reported as a large river species by Moriyama and McCafferty (1979a), which is supported by our collections from rivers with drainage areas of 1469 and 2203 mi².

NEW OHIO RECORDS: Hamilton County: Whitewater River, W of Hooen at Suspension Bridge Road, RM 1.50, DA 1469 mi², 39.1831, -84.7928, 08-VIII-2016, S.K. Macy; **Paulding County:** Maumee River, N of Cecil at CR 105, RM 85.26, DA 2203 mi², 41.2378, -84.6022, 22-VIII-2012, M. Gray.

Plauditus punctiventris (McDunnough).— These new records from Ohio were from small streams in the Western Allegheny Plateau and the Erie/Ontario Lake Plain ecoregions with drainage areas ranging from 3.3 to 17.7 mi². The Ohio EPA previously misidentified specimens of *Iswaeon anoka* (Daggy) as this species based on Ide (1937). McCafferty et al. (2005) detailed the complex and intertwined history of *I. anoka* and *P. punctiventris*. The records presented here were identified with the key of McCafferty et al. (2017), which provides sufficient detail to identify later instars of all *Plauditus* species known as larvae.

NEW OHIO RECORDS: Ashtabula County: Ashtabula River, at Tannery Hill Road, RM 3.6, DA 127 mi², 41.8729444, -80.7792, 22-VIII-2011, M.J. Bolton; Conneaut Creek, near OH/PA Border at Furnace Road, RM 23.24, DA 154.00 mi², 41.9039, -80.5294, 17-IX-2015, S.K. Macy; Conneaut Creek, SE of Conneaut at State Road (CR 354), RM 17.20, DA 158.00 mi², 41.8864, -80.6208, 15-IX-2015, S.K. Macy; Conneaut Creek, near Kingsville at S. Ridge Road, RM 13.46, DA 168.00 mi², 41.892737, -80.667803, 15-IX-2015, S.K. Macy; Conneaut Creek, at Big D Campground, RM 12.27, DA 171.00 mi², 41.901902, -80.652825, 15-IX-2015, S.K. Macy; Conneaut Creek, at Conneaut at Main Street, RM 2.56, DA 187.00 mi², 41.943632, -80.550568, 14-IX-2015, S.K. Macy; **Carroll County:** Elliot Run, at Clay Rd., RM 1.4, DA 3.5 mi², 40.5782, -81.2148, 30-VIII-2016, S.K. Macy; **Coshocton County:** Darling Run, at lane (TR 1240) off TR 340 at Nellie Cemetery, RM 0.10, DA 3.3 mi², 40.34363, -82.04922, 01-VII-2010, A.A. Dripps; Dutch Run, at TR 344/TR 338, RM 0.8, DA 5.4 mi², 40.366959, -82.096562, 01-VII-2010, A.A. Dripps; **Guernsey County:** Clear Fork, at Rye Lane S of Birmingham at TR 5880, RM 1.83, DA 13.7 mi², 40.1472, -81.4542, 17-VII-2014, L.B. Hughes; Marlatt Run (tributary to Wills Creek at RM 24.0), at Marlatt Run Road, RM 0.4, DA 7.1 mi², 40.210548, -81.664224, 06-VIII-2014, L.B. Hughes; **Jackson County:** Dickason Run, Keystone Furnace Rd., RM 2.37, DA 17.7 mi², 39.0108, -82.4889, L.B. Hughes; **Meigs County:** Tributary to West Branch Shade River (RM 16.35), at SR 681, RM 0.10, DA 8.3 mi², 39.169967, -82.079777, 13-VII-2015, L.B. Hughes; West Branch Shade River, at SR 681 W of Burlingham, RM 16.50, DA 10.9 mi², 39.170327, -82.081507, 13-VII-2015, L.B. Hughes.

Ephemeroptera: Ephemeridae

***Ephemera guttulata* Pictet.**— This species was keyed in McCafferty (1975) and has a primarily Appalachian distribution from Maine to Alabama, but with isolated populations in the Ozark Plateau of Arkansas (McCafferty 1994). These new records from Ohio are based on specimens collected from first-order headwater streams in the unglaciated Western Allegheny Plateau ecoregion with drainage areas ranging from 0.1 to 0.6 mi². Associated coldwater taxa included the mayflies *Ameletus* sp.

and *Epeorus* sp.; the dragonflies *Boyeria grafiانا* Williamson (Aeshnidae) and *Lanthus parvulus* (Selys) (Gomphidae); the stoneflies *Amphinemura* sp., *Leuctra* sp., *Clioperla clio* (Newman) (Perlodidae) and *Sweltsa* sp.; the fishfly *Nigronia fasciata*; the caddisflies *Diplectrona modesta*, *Molanna* sp., and *Goera* sp. (Goeridae); and the true fly *Dixa* sp. (Dixidae). Randolph and McCafferty (1998) predicted its presence in Ohio based on its occurrence in east-central Kentucky.

NEW OHIO RECORDS: **Adams County:** Mackenzie Run, ust. Waggoner Riffle Road, RM 0.20, DA 0.6 mi², 38.7195, -83.448044, 20-VIII-2014, M.J. Bolton; Waggoner Run, SW of Tulip, ust. Abner Hollow Road, RM 1.04, DA 0.3 mi², 38.71966, -83.43224, 04-IX-2013, L.B. Hughes; **Belmont County:** tributary to tributary to Stillwater Creek (at RM 0.23/RM 56.37), W of Bethesda, RM 0.15, DA 0.1 mi², 40.015203, -81.105944, 25-IX-2013, R. Taulbee.

Ephemeroptera: Heptageniidae

***Leucrocuta walshi* (McDunnough).**— This species is found primarily in northeastern North America, with Ohio previously thought to be at the southwestern extent of its range (Randolph and McCafferty 1998). Our new data from Indiana extend its range slightly. The species remains unknown in the larval stage, and the genus *Leucrocuta* is in need of revision (Webb et al. 2012, Klubertanz 2016, McCafferty et al. 2017).

NEW INDIANA RECORD: **Brown County:** Van Buren Township, New Bellsville, at UV light trap, 39.1380, -86.1174, 13-VI-2012, A.A. and L.M. Jacobus, 1 adult ♂ [LMJ, to be deposited in PERC].

***Macdunnoa persimplex* (McDunnough).**— Flowers (1982) reported *Macdunnoa* larvae from the Ohio River, but he provided no record data. Randolph and McCafferty (1998) discussed a discounted report of this species from Ohio. McCafferty (2009) reported adults of this species from Athens County, the southeastern corner of which is bordered by the Ohio River.

CONFIRMED OHIO RECORD OF LARVAE. **Brown County:** Ohio River, 1-VI-1976, D.C. Beckett, 2 larvae [FAMU].

Ephemeroptera: Leptophlebiidae

***Habrophlebia vibrans* Needham.**— This is an eastern North American species, known from Canada south to northwest Florida (Bernier and Pescador 1988, Randolph and McCafferty 1998). It is distinct within the genus, being the sole representative of the subgenus *Hesperaphlebia* (Peters 1979). These new records from Ohio were found in first-order headwater streams with drainage areas from 0.2 to 0.4 mi² within eastern Ohio. It was found in association with coldwater taxa including the mayfly *Habrophlebiodes* sp.; the dragonfly *Lanthus parvulus*; the stoneflies *Amphinemura* sp., *Leuctra* sp., and *Eccopectura xanthenes* (Newman); the fishfly *Nigronia fasciata* (Walker); the caddisflies *Dolophilodes distinctus*, *Wormaldia moesta*, *Diplectrona modesta*, *Parapsyche apicalis* (Banks) (Hydropsychidae), *Rhyacophila carolina* Banks (Rhyacophilidae), *Oligostomis pardalis* (Walker) (Phryganeidae), *Frenesia* sp. (Limnephilidae), and *Lepidostoma* sp.; and the true flies *Dicranota* sp. (Tipulidae), *Pedicia* sp., *Limnophila* sp., *Macropelopia* sp. (Chironomidae), *Trissopelopia ogemawi*, *Pagastia orthogonia* Oliver (Chironomidae), *Prodiamesa olivacea* (Meigen) (Chironomidae), and *Polypedilum* (U.) *aviceps*. Randolph and McCafferty (1998) had predicted that it would eventually be collected from Ohio.

NEW OHIO RECORDS: **Athens County:** tributary to Carbondale Creek (at RM 0.67), about 0.8 km NW of Carbondale, RM 0.1, DA 0.2 mi², 39.3836, -82.2753, 14-IX-2018, S.K. Macy, M.J. Bolton; **Geauga County:** tributary to Dew Dale Creek (at RM 0.22) (Leech Tributary), RM 0.5, DA 0.3 mi², 41.4999, -81.2803, 26-VI-2009, P. Anderson; **Hocking County:** tributary to Queer Creek (at RM 4.42), Hamilton Hollow, ust. SR 664, RM 0.1, DA 0.4 mi², 39.42602, -82.57359, 2-VIII-2018, S.K. Macy, M.J. Bolton.

Ephemeroptera: Oligoneuriidae

***Homoeoneuria ammophila* (Spieth).**— The holotype of this species was described from Decker, Indiana, while 25 paratypes were from Hazleton, both on the lower White River where it separates Knox and Gibson counties (Spieth 1938). These specimens were collected between 1932 and 1936. No specimens from Indiana have been reported since, resulting in the species being listed as endangered (IDNR 2018). The species has not been reported from Ohio, but it is known to occur relatively widely in the midwestern U.S.A. (e.g., Randolph and McCafferty 1998, McCafferty et al. 2001, 2003, Jungclaus-Meier et al. 2010, Klubertanz 2016). We present the first Indiana records for the species since the original description. In the new locations,

both rivers were sand-bottomed. Larvae were secured by wading out to chest-high water and dipnetting sandbars and troughs. Many adults were seen in the early morning hours at the Kankakee River location, where they were nearly impossible to obtain given their competent, agile flight. At this location, males conducted a horizontal swarm just above the water surface, where they captured emerging female subimagos, mating them on the wing—partial shedding of subimaginal skin of females was observed when they were coupled. All adults died that same day at about 1000 hours, when they were found floating downstream and could be easily collected.

ADDITIONAL INDIANA RECORDS: **Newton County:** Kankakee River, 2 km SE Illiana Heights, IL at CR 18000E (state line). 41.1654, 87.5264, 9-IX-2006, R.E. DeWalt, RED-2006-251, 2 ♂ imagoes, 15 ♀ subimagos, 9 larvae [INHS Insect Collection-164914]; **Pulaski County:** Tippecanoe River, 8 km NNE Winamac, Tippecanoe State Park. 41.1316, -86.588, 9-IX-2006, R.E. DeWalt, RED-2006-253, 7 larvae, 1 adult ♀ [INHS Insect Collection-164926].

Ephemeroptera: Palingeniidae

***Pentagenia vittigera* (Walsh).**— Klubertanz (2016) considered this species to be among the most poorly known mayflies from large rivers in North America. Although relatively widespread in the central and southeastern parts of North America, it has never been found in Ohio. Randolph and McCafferty (1998) reported several records of this species from the Wabash and lower White River drainages of western Indiana. Most midwestern records of this species are old, and new data from south-central and southwestern Indiana confirm its continued existence in the region. If *Pentagenia* specimens are collected from Ohio, they should be compared to descriptions of the presumably extinct *P. robusta* (McDunnough 1926, McCafferty 2001).

ADDITIONAL INDIANA RECORDS: **Knox County:** White River, Petersburg Access, IN-61, 38.362205, -86.449345, 22-VI-2017, E. A. Newman, EAN-2017-031, UV Light, 1 ♂ imago [INHS Insect Collection-660500]; **Martin County:** East Fork White River, 0.5 km SSW Shoals, 38.6591, -86.8023, 22-VI-2006, R.E. DeWalt, RED-2006-197, 2 ♂ imagoes [INHS Insect Collection-654700].

Ephemeroptera: Potamanthidae

***Anthopotamus verticis* (Say).**— This species has never been reported from Ohio, though it is thought to be common in the midwestern U.S.A. (Bae and McCafferty 1991).

NEW OHIO RECORD: **Lake County.** Willoughby, 20-VII-1936, J.R. Traver, adult reared from subimago, pinned [PERC].

Plecoptera: Perlodidae

***Isoperla frisoni* Illies.**— Despite recent large-scale efforts in Ohio by DeWalt et al. (2012), DeWalt et al. (2016), and DeWalt and Snyder (2017), yet another stonefly heretofore unknown for Ohio has been recognized. Material borrowed from Dr. Richard W. Baumann, emeritus curator at the Monte L. Bean Museum at Brigham Young University (BYU), presented a single male of *Isoperla frisoni* Illies. This species is known from the following states and provinces: Canada: MB, NB, NS, ON, PE, PQ; USA: CT, DE, GA, IN, ME, MI, MN, NC, NY, PA, SC, TN, VA, WI (Szczytko and Kondratieff 2015, DeWalt et al. 2018). No information on method of collection was provided and the locality was somewhat vague, so this specimen may have flown to the collection locality from elsewhere. This record brings the Ohio count to 103 stonefly species.

NEW OHIO RECORD: **Highland County:** small stream, 9.7 km E of Greenfield, 39.35519, -83.27008, 5-VI-1966, H.J. Harlan, 1 adult ♂ [BYU-167733].

Trichoptera: Brachycentridae

***Brachycentrus nigrosoma* (Banks).**— The larvae of this species was illustrated and keyed in Flint (1984) and Morse et al. (2017). This species has a distribution primarily along the Appalachians from Maine to Alabama and Georgia. Within Ohio, it has only been found in the extreme northeastern corner of the state, along with the rarely collected caddisfly *Chimarra socia* Hagen (Philopotamidae) and chironomid *Rheopelopia acra* (Roback).

NEW OHIO RECORD: Ashtabula County: Conneaut Creek, at Conneaut at Main Street, RM 2.56, DA 187 mi², 41.943632, -80.550568, 14-IX-2015, S.K. Macy.

Trichoptera: Goeridae

***Goerita betteni* Ross.**— This record is a confirmation of an asserted Ohio distribution presented in Phillippi and Schuster (1987) for which no specimen data or repository was presented. Because the record could not be verified, Armitage et al. (2011) recorded this species as doubtful. Four adult males were taken with a beating sheet adjacent to a small, sandstone bedrock stream in the Grand River drainage of northeast Ohio, in conditions much as reported by Phillippi and Schuster (1987) for their Kentucky records. Parker (1998) published the latest review of the genus.

NEW OHIO RECORD: Lake County: Phelps Creek, 5.1 km SW Thompson at Thompson Road, 41.66435, -81.11648, 8-VI-2013, R.E. DeWalt, E.J. Smith, 4 adult ♂, RED-2013-096 [INHS InsectCollection-790021].

Trichoptera: Hydropsychidae

***Homoplectra doringa* (Milne).**— The genus *Homoplectra* Weaver consists of eight western and three eastern U.S.A. species (Weaver 1985). The larvae of *H. doringa* have a pronounced emargination on the left side of the anterior border of the frontoclypeal apotome characteristic of the species *H. doringa* and *H. monticola* (Wiggins 1996). These two species can be separated by comparison of the figures in Weaver et al. (1979) and Wiggins (1996) and the key in Morse et al. (2017). Species of *Homoplectra* in the eastern U.S. have been reported to inhabit high-gradient intermittent seeps (Huryn 1989). Within Ohio, this taxon has been found in first-order headwater and small streams with drainage areas ranging from 0.1 to 1.2 mi². It was found in association with coldwater taxa including the mayflies *Ameletus* sp. and *Epeorus* sp.; the stoneflies *Amphinemura* sp., *Leuctra* sp., and *Diploperla robusta*; and the caddisflies *Diplectrona modesta* and *Rhyacophila* sp. (*R. fenestra* or *R. ledra*). In Indiana, larvae are known from small seepage streams and in one stream up to 5 m width in Dearborn, Franklin, and Monroe counties. Eight adult specimens from two collections identified by H. H. Ross as *Aphropsyche aprilis* Ross are currently in the INHS collection (cat. # Trichoptera-31107 and 31109), as reported in Waltz and McCafferty (1983). This taxon is a junior synonym of *H. doringa*. Others have made the assumption that all *Homoplectra* in Indiana are *doringa* (Weaver 1985, Rasmussen and Morse 2018).

NEW OHIO RECORDS: Adams County: Puntteney Run, N of Squirrel Town adj. Puntteney Run Road, RM 1.35, DA 0.5 mi², 38.71226, -83.38903, 4-IV-2013, L.B. Hughes; **Brown County:** Scott Run, at US 68, RM 0.20, DA 1.2 mi², 38.839111, -83.842949, 11-VIII-2015, M.J. Bolton; **Hamilton County:** tributary to Great Miami River (at RM 19.60), at Glen Oak Nature Preserve, RM 0.90, DA 0.1 mi², 39.25041, -84.68828, 7-V-2014, M.J. Bolton, S.K. Macy, **Monroe County:** tributary to Ohio River (at RM 847.7), within Wayne National Forest, RM 0.7, DA 0.05 mi², 39.61393, -80.94571, 25-III-2016, L.B. Hughes; tributary to Ohio River (at RM 847.7), within Wayne National Forest, RM 0.7, DA 0.05 mi², 39.61393, -80.94571, 26-III-2017, L.B. Hughes; tributary to Ohio River (at RM 847.7), within Wayne National Forest, RM 0.7, DA 0.05 mi², 39.61393, -80.94571, 17-V-2018, 1 adult ♀ (reared from larva), L.B. Hughes.

Trichoptera: Leptoceridae

***Ceraclea nepha* (Ross).**— This species has been reported from AL, AR, DE, FL, GA, IL, KS, KY, MI, MN, MO, MS, NC, OK, SC, TN, TX, VA, and WI (Morse et al. 2017), and in the southeastern U.S., it is often found in waters with high tannic acid content (Resh 1976).

NEW OHIO RECORD: Summit County: Wolf Creek, at railroad near mouth, RM 0.19, DA 77 mi², 41.0028, -81.6089, 8-VIII-2017, E.L. Moore.

Trichoptera: Phryganeidae

***Fabria inornata* (Banks).**— The larvae of this species was illustrated and keyed in Wiggins (1996, 1998). This species was found in the Ashtabula River/Lake Erie lacustrine amongst macrophytes. These five additional caddisfly taxa bring the confirmed number of Ohio Trichoptera species to 275.

NEW OHIO RECORD: Ashtabula County: Ashtabula River, at Ashtabula dst. Fields Brook, RM 1.5, 41.8933, -80.7972, 24-IX-2014, C.E. McKnight.

Coleoptera: Elmidae

***Oulimnius nitidulus* (LeConte).**— Two species of *Oulimnius* occur in eastern North America, primarily along the Appalachian Mountains and as far northeast as Quebec, Canada, and as far southwest as Mississippi and the Florida panhandle (Brown 1983, Epler 2005, 2009). *O. nitidulus* has probably been underreported since Sanderson (1953-54) listed it as a synonym of *O. latiusculus* (LeConte), both in the genus *Limnius*. Brown (1972) did not include *O. nitidulus*. Aquatic biologists using *An Introduction to the Aquatic Insects of North America* as their main source of information would have seen that there was only one species in editions one through three (Merritt and Cummins 1978, 1984, 1996). The fourth edition (Merritt et al. 2008) had *Oulimnius* with two species. Some of the older records for *O. latiusculus* were probably specimens of *O. nitidulus*. Diagnostic characters to separate the two species can be found in Downie and Arnett (1996) and Epler (2010). This specimen was found in a small stream in unglaciated southern Ohio. It was associated with coldwater taxa including the mayfly *Habrophlebiodes* sp., the stoneflies *Leuctra* sp. and *Sweltsa* sp., the fishfly *Nigronia fasciata*, the caddisfly *Diplectrona modesta*, and the chironomid *Polypedilum* (U.) *aviceps*. Southern Ohio is roughly on the edge of this species' range; it was recorded from the adjacent state of West Virginia in Brown (1983). *O. latiusculus* was recorded from the adjacent states of Indiana, Kentucky, and West Virginia in Brown (1983).

NEW OHIO RECORD: Adams County: Mackenzie Run, upt. Waggoner Riffle Road, RM 0.2, DA 0.6 mi², 38.7195, -83.448044, 11-IX-2018, S.K. Macy, M.J. Bolton, 1 adult.

Diptera: Chironomidae

***Cricotopus (Isocladius)* sp. "Ozarks" Epler 2001.**— The larvae of this taxon, along with *C. sp. "Santa Fe,"* were illustrated and keyed by Epler (2001). These species are similar to *Cricotopus (Isocladius)* sp. nr. *absurdus* in Bolton (2012). Epler questioned whether these are three species or the extremes of a variable species. *Cricotopus* sp. nr. *absurdus* has been collected from 16 stream stations in Ohio with drainage areas ranging from 7.2 to 869 mi² from Adams, Butler, Clark, Clermont, Cuyahoga, Hamilton, Miami, Paulding, Preble, Shelby, and Wood counties.

NEW OHIO RECORD: Hamilton County: Whitewater River, W of Hooven at Suspension Bridge Road, RM 1.50, DA 1469 mi², 39.1831, -84.7928, 8-VIII-2016, S.K. Macy.

NEW INDIANA RECORDS: Harrison County: Blue River, Harrison Spring Road, DA 485 mi², 38.22925555, -86.22512602, 7-IX-2010, P.D. McMurray [IDEM]; Indian Creek, Water Street, DA 151.3 mi², 38.21650726, -86.12927067, 25-VIII-2010, P.D. McMurray [IDEM]; **Monroe County:** Clear Creek, W Country Club Drive, DA 5.8 mi², 39.13611912, -86.53357496, 29-VIII-2016, P.D. McMurray [IDEM].

***Cricotopus (Isocladius)* sp. "Santa Fe" Epler 2001.**— Epler (2001) was only aware of this taxon from northern Florida. This record from southwest Ohio is a substantial range extension north.

NEW OHIO RECORD: Hamilton County: Muddy Creek, at Cleves Warsaw Pike, RM 2.72, DA 10.5 mi², 39.123633, -84.677562, 22-IX-2014, M. Knapp.

***Fittkauimyia* sp. [probably *F. serti* (Roback)].**— Single larval specimens were collected from small streams in southern Ohio and central Indiana. This genus has been reported from North America as far north as Oklahoma and North Carolina (Epler 2001, Cranston and Epler 2013). These records are a substantial range extension north.

NEW OHIO RECORD: Scioto County: Candy Run, adj. dirt lane, RM 2.2, DA 5.4 mi², 38.860589, -82.973795, 14-VIII-2017, J. Freda.

NEW INDIANA RECORD: Greene County: Bridge Creek, CR 25 N, DA 4.5, mi², 39.02666406, -86.80329971, 16-VIII-2011, T.E. Davis [IDEM].

***Parakiefferiella* sp. F Epler 2001.**— Epler (2001) illustrated and keyed the larvae of this taxon. He was only aware of specimens

from northern Florida. This record from northwest Ohio is a substantial range extension north.

NEW OHIO RECORD: Paulding County: Prairie Creek, S of Melrose at Mercile Road, RM 5.90, DA 49.7 mi², 41.053528, -84.45753, 27-VIII-2014, S.K. Macy.

***Saetheria hirta* Sæther.**— This species has been reported from only North and South Carolina (Epler 2001). This record from southern Ohio is a substantial range extension north.

NEW OHIO RECORD: Gallia County: Strongs Run, NE of Ewington at Adney Road, RM 0.58, DA 16.4 mi², 39.0147, -82.3361, 12-VII-2016, L.B. Hughes.

Discussion

A total of 24 mayflies, stoneflies, caddisflies, riffle beetles, and chironomids were recorded for the first time in Ohio. The slight majority (13 taxa) were mayflies, 10 of which were in the family Baetidae. Four of the new Ohio records were for baetid “species” with informal names: *Anafroptilum minor* group species 1 and 2 and *Heterocloeon (Jubilatum)* species B and D. This suggests that there are multiple species within the *A. minor* group, though in McCafferty et al. (2017), they all key to *A. minor*. Color patterns presented in Figures 3 & 4 seem to suggest at least two species in Ohio. McCafferty et al. (2017) key four southeast U.S.A. *Heterocloeon* with informal names (A-D); two of the informally described taxa occur in Ohio. Additional confirming records for the rare heptageniid mayfly *Macdunnoa persimplex* and the goerid caddisfly *Goerita betteni* were also presented.

Four new records for Indiana were presented: the baetid mayfly *Heterocloeon (Jubilatum)* species D, the heptageniid mayfly *Leucrocuta walshi*, and the chironomids *Cricotopus (Isocladius)* sp. “Ozarks” and *Fittkauimyia* sp. [probably *F. sarta* (Roback)]. Two records confirming the presence of rare mayfly species in Indiana were presented for *Homoeoneuria ammophila* and *Pentagenia vittigera*. Both are found in larger rivers, the former in sand-bottomed systems and the latter requiring clay banks in which to dig burrows. These species have not been seen in decades.

The concerted and statewide efforts of the OEPA frequently generate new and important distributional records for aquatic insects in Ohio. Keeping voucher specimens and recording specimen records in digital form allow these data to serve multiple objectives for the state. Similar work is needed in Indiana to locate rare species and to confirm additional ones that have not been collected in many years. A concerted effort to digitize the Purdue University collection and conduct surveys for the adults and larvae of mayflies, stoneflies, and caddisflies would likely yield important findings that would also simultaneously meet several objectives such as assessment of conservation status and description of new species.

Acknowledgements

We thank Laura Hughes (formerly with Ohio EPA) for some of the photographs of mayfly larvae and the reared female specimen of *Homoplectra doringa*, Bob Miltner and Jordan Jenkins (Ohio EPA) for help with data retrieval, Kyleigh Godsey (Ohio EPA) for help with typing part of the manuscript, Jack Freda and Marty Knapp (Midwest Biodiversity Institute) for providing specimens of *Cricotopus (Isocladius)* sp. “Santa Fe” and *Fittkauimyia* sp. [probably *F. sarta*], Paul McMurray (Indiana Department of Environmental Management) for the collection records of *Fittkauimyia* sp. [probably *F. sarta*] and *Cricotopus (Isocladius)* sp. “Ozarks” from Indiana, and the past and present members of the Ohio EPA Macroinvertebrate Group for their help and support: Bernie Counts, Jeff DeShon, Angela Dripps, Jack Freda, Mike Gray, Laura Hughes, Marty Knapp, Chuck McKnight, and Ed Moore. Some specimens donated to the INHS by the Ohio Biological Survey made their way into this treatment. We acknowledge the foresight of Brian J. Armitage, Boquete, Panama, for donation of this valuable material to the INHS. Partial support for accumulation and digitization of some specimen data presented herein was provided by grants to DeWalt from the NSF (DEB 09-18805 ARRA, DBI CSBR 14-58285) and from the U.S. Department of the Interior (INT RD X-1-R-1).

Literature Cited

Armitage, B.J., S.C. Harris, G.A. Schuster, J.D. Usis, D.B. MacLean, B.A. Foote, M.J. Bolton, and R.J. Garano. 2011. Atlas of Ohio aquatic insects. Volume I. Trichoptera. Ohio Biological Survey Miscellaneous Contribution Number 13. iv

+ 88 p.

- Bae, Y.J., and W.P. McCafferty. 1991.** Phylogenetic systematics of the Potamanthidae (Ephemeroptera). Transactions of the American Entomological Society 117(3-4): 1-143.
- Bednarik, A.F., and W.P. McCafferty. 1977.** A checklist of the stoneflies, or Plecoptera, of Indiana. Great Lakes Entomologist 10: 223-226.
- Berner, L., and M.L. Pescador. 1988.** The mayflies of Florida. University Presses of Florida, Gainesville, Florida. xvi + 415 p.
- Bolton, M.J. 1992.** Chironomidae (Diptera) of Cedar Bog, Champaign County, Ohio. The Ohio Journal of Science 92(5): 147-152.
- Bolton, M.J. 2010 (Published 2011).** New state records of aquatic insects for Ohio, U.S.A. (Ephemeroptera, Plecoptera, Trichoptera, Coleoptera). Entomological News 121(1): 75-90.
- Bolton, M.J. 2012.** Ohio EPA supplemental keys to the larval Chironomidae (Diptera) of Ohio and Ohio Chironomidae checklist. Ohio Environmental Protection Agency, Division of Surface Water, Columbus, Ohio. 111 p. http://epa.ohio.gov/Portals/35/documents/Midge_Larvae_Key_nov2012.pdf
- Brown, H.P. 1972.** Aquatic dryopoid beetles (Coleoptera) of the United States. Biota of Freshwater Ecosystems Identification Manual No. 6, U.S. Environmental Protection Agency. 82 p. (reprinted 1976).
- Brown, H.P. 1983.** A catalog of the Coleoptera of America north of Mexico, Family: Elmidae. Agricultural Research Service, U.S. Department of Agriculture, Washington D.C. Agriculture Handbook Issue 529, Part 50. 23p.
- Burian, S.K., and L.W. Myers. 2011.** A new species of *Acentrella* Bengtsson (Ephemeroptera: Baetidae) from New York and New England (USA), redescription of the nymph of *A. parvula* (McDunnough), and key to known adult males of Nearctic *Acentrella*. Aquatic Insects 33(4): 305-334.
- Cranston, P.S., and J.H. Epler. 2013.** 5. The larvae of Tanypodinae (Diptera: Chironomidae) of the Holarctic Region: keys and diagnoses. In: Anderson, T., P.S. Cranston, and J.H. Epler (Sci. eds.). Chironomidae of the Holarctic Region: keys and diagnoses: larvae. Insect Systematics and Evolution, Supplements 66: 1-573.
- DeWalt, R.E., Y. Cao, T. Tweddle, S.A. Grubbs, L. Hinz, M. Pessino, and J.L. Robinson. 2012.** Ohio USA stoneflies (Insecta, Plecoptera): species richness estimation, distribution of functional niche traits, drainage affiliations, and relationships to other states. ZooKeys 178: 1-26. doi: 10.3897/zookeys.178.2616
- DeWalt, R.E., and D.S. Elise. 2017.** Plecoptera of Crane Hollow Nature Preserve, Ohio, comparison to similar efforts. Illiesia 13(06): 70-81. <https://doi.org/10.25031/2017/13.06>
- DeWalt, R.E., and S.A. Grubbs. 2011.** Updates to the stonefly fauna of Illinois and Indiana. Illiesia 7(3): 31-50.
- DeWalt, R.E., S.A. Grubbs, B.J. Armitage, R.W. Baumann, S.M. Clark, and M.J. Bolton. 2016.** Atlas of Ohio aquatic insects. Volume II. Plecoptera. Biodiversity Data Journal 4: e10723. <https://doi.org/10.3897/BDJ.4.e10723>
- DeWalt, R.E., M.D. Maehr, U. Neu-Becker, and G. Stueber. 2018.** Plecoptera Species File Online. Version 5.0/5.0. 31 January 2018. <http://Plecoptera.SpeciesFile.org>
- DeWalt, R.E., E.J. South, D.R. Robertson, J.E. Marburger, W.W. Smith, and V. Brinson. 2016.** Mayflies, stoneflies, and caddisflies of streams and marshes of Indiana Dunes National Lakeshore, USA. ZooKeys 556: 43-63.
- Discover Life. 2018.** *Centroptilum minor* (McDunnough, 1926) species page. <http://www.discoverlife.org/mp/20q?search=C+centroptilum+minor>
- Downie, N.M., and R.H. Arnett, Jr. 1996.** The beetles of northeastern North America. Volume I. The Sandhill Crane Press, Gainesville, Florida. 880 p.
- Epler, J.H. 2001.** Identification manual for the larval Chironomidae (Diptera) of North and South Carolina. A guide to the taxonomy of the midges of the southeastern United States, including Florida. Special Publication SJ2001-SP13. North Carolina Department of Environmental and Natural Resources, Raleigh, NC, and St. John's River Water Management District, Palatka, Florida. 526 p.
- Epler, J.H. 2009.** More new distribution records for Florida water beetles (Coleoptera: Dytiscidae, Elmidae, Hydrophilidae, Scirtidae), with additional notes on *Scirtes oblongus* Guerin-Meneville. Insecta Mundi 0087: 1-4 plus erratum.
- Epler, J.H. 2010.** The water beetles of Florida. State of Florida, Department of Environmental Protection, Division of Environmental Assessment and Restoration, Tallahassee. 414 p.
- Epler, J.H., D.H. Ray, and T.A. Thom. 2005.** New distribution records for water beetles (Coleoptera: Elmidae, Gyrinidae) in Florida. The Coleopterists Bulletin 59(2): 270-271.
- Flint, O.S., Jr. 1984.** The genus *Brachycentrus* in North America, with a proposed phylogeny of the genera of Brachycentridae (Trichoptera). Smithsonian Contributions to Zoology Number 398. Smithsonian Institution Press, Washington D.C. iv + 58 p.
- Flowers, R.W. 1982.** Review of the genus *Macdunnoa* (Ephemeroptera: Heptageniidae) with description of a new species from Florida. Great Lakes Entomologist 15: 25-30.
- Glotzhober, R.C., and D. McShaffrey. (Eds.) 2002.** The dragonflies and damselflies of Ohio. Ohio Biological Survey Bulletin New Series 14(2). 364 p.
- Grubbs, S.A. 2004.** Studies on Indiana stoneflies (Plecoptera), with an annotated and revised state checklist. Proceedings of

- the Entomological Society of Washington 106(4): 865-876.
- Huryn, A.D. 1989.** Identity of the hydropsychid larva known as “*Oropsyche*”: the immature stages of *Homoplectra flinti* Weaver. Journal of the North American Benthological Society 8(1): 112-116.
- Ide, F.P. 1937.** Descriptions of eastern North American species of baetinae mayflies with particular reference to the nymphal stages. The Canadian Entomologist 69(11): 235-243.
- Indiana Department of Natural Resources (IDNR). 2018.** Indiana endangered plant and wildlife species. Accessed 4/20/2018. <https://www.in.gov/dnr/naturepreserve/4725.htm>
- Jacobus, L.M. 2016.** An annotated list of Indiana mayflies (Insecta: Ephemeroptera). A report submitted to: Indiana Natural Heritage Data Center, Indianapolis, Indiana. 21 p.
- Jacobus, L.M., and W.P. McCafferty. 2006.** Notable records of Ephemeroptera (Baetidae, Leptophlebiidae, Metretopodidae) from Indiana, U.S.A. Entomological News 117(3): 344-346.
- Jacobus, L.M., and N.A. Wiersema. 2014.** The genera *Anafroptilum* Kluge, 2011 and *Neocloeon* Traver, 1932, reinstated status, in North America, with remarks about the global composition of *Centroptilum* Eaton, 1869 (Ephemeroptera: Baetidae). Zootaxa 3814(3): 385-391.
- Jungclaus-Meier, A., W.R. Mabee, and M.D. Combes. 2010.** First record on occurrence of *Homoeoneuria* (Ephemeroptera: Oligoneuriidae) in a wadeable stream in Missouri. Transactions of the Missouri Academy of Science 44/45: 44-46.
- Klubertanz, T.H. 2016.** Mayfly larvae of Wisconsin. University of Wisconsin, Cooperative Extension Publishing. viii + 291 p.
- Mayfly Central. 2019.** Species list–North America. Purdue University, Department of Entomology. <https://www.entm.purdue.edu/mayfly/na-species-list.php>
- McCafferty, W.P. 1975.** The burrowing mayflies (Ephemeroptera: Ephemerioidea) of the United States. Transactions of the American Entomological Society 101: 447-504.
- McCafferty, W.P. 1994.** Distributional and classificatory supplement to the burrowing mayflies (Ephemeroptera: Ephemerioidea) of the United States. Entomological News 105: 1-13.
- McCafferty, W.P. 2000.** Reporting species record data. Entomological News 111: 311-312.
- McCafferty, W.P. 2001.** Status of some historically unfamiliar American mayflies (Ephemeroptera). Pan-Pacific Entomologist 77: 210-218.
- McCafferty, W.P. 2009.** New state and provincial North American records for 100 Ephemeroptera species. Transactions of the American Entomological Society 135: 353-368.
- McCafferty, W.P., T. Hubbard, T.H. Klubertanz, R.P. Randolph, and M. Birmingham. 2003.** Mayflies (Ephemeroptera) of the Great Plains. II. Iowa. Transactions of the American Entomological Society 129: 77-105.
- McCafferty, W.P., L.M. Jacobus, A.V. Provonsha, and N.A. Wiersema. 2017.** Chapter 2. Ephemeroptera, pp.15-160. In: Morse, J.C., W.P. McCafferty, B.P. Stark, and L.M. Jacobus (eds.). 2017. Larvae of the southeastern USA mayfly, stonefly, and caddisfly species. Biota of South Carolina. Volume 9. Clemson University Public Service Publishing, Clemson University, Clemson, South Carolina. 482 p.
- McCafferty, W.P., T.H. Klubertanz, R.P. Randolph, A.V. Provonsha, H.R. Lawson, and B.C. Kondratieff. 2001.** Mayflies (Ephemeroptera) of the Great Plains. I: Nebraska. Transactions of the American Entomological Society 127: 5-29.
- McCafferty, W.P., M.D. Meyer, J.M. Webb, and L.M. Jacobus. 2004.** New state and provincial records for North American small minnow mayflies (Ephemeroptera: Baetidae). Entomological News 115(2): 93-100.
- McCafferty, W.P., and R.D. Waltz. 1995.** *Labiobaetis* (Ephemeroptera: Baetidae): new status, new North American species, and related new genus. Entomological News 106(1): 19-28.
- McCafferty, W.P., R.D. Waltz, J.M. Webb, and L.M. Jacobus. 2005.** Revision of *Heterocloeon* McDunnough (Ephemeroptera: Baetidae). Journal of Insect Science 5(35): 1-11.
- McDunnough, J. 1926.** Notes on North American Ephemeroptera with descriptions of new species. Canadian Entomologist 58: 184-196.
- Merritt, R.W., and K.W. Cummins (eds.). 1978.** An introduction to the aquatic insects of North America. Kendall/Hunt Publishing Company, Dubuque, Iowa. 441 p.
- Merritt, R.W., and K.W. Cummins (eds.). 1984.** An introduction to the aquatic insects of North America. Second edition. Kendall/Hunt Publishing Company, Dubuque, Iowa. 722 p.
- Merritt, R.W., and K.W. Cummins (eds.). 1996.** An introduction to the aquatic insects of North America. Third edition. Kendall/Hunt Publishing Company, Dubuque, Iowa. 862 p.
- Merritt, R.W., K.W. Cummins, and M.B. Berg (eds.). 2008.** An introduction to the aquatic insects of North America. Fourth edition. Kendall/Hunt Publishing Company, Dubuque, Iowa. 1158 p.
- Morihara, D.K., and W.P. McCafferty. 1979a.** Systematics of the *propinquus* group of *Baetis* species America (Ephemeroptera: Baetidae). Annals of the Entomological Society of America 72(1): 130-135.
- Morihara, D.K., and W.P. McCafferty. 1979b.** The *Baetis* larvae of North America (Ephemeroptera: Baetidae). Transactions of the American Entomological Society 105: 139-221.
- Morse, J.C., R.W. Holzenthal, and O. Yadamsuren. 2017.** Chapter 4. Trichoptera, pp. 248-442. In: Morse, J.C., W.P.

- McCafferty, B.P. Stark, and L.M. Jacobus (eds.). 2017. Larvae of the southeastern USA mayfly, stonefly, and caddisfly species. Biota of South Carolina. Volume 9. Clemson University Public Service Publishing, Clemson University, Clemson, South Carolina. 482 p.
- Ohio Environmental Protection Agency. 2015.** Biological criteria for the protection of aquatic life: Volume III. Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities. Division of Surface Water, Columbus, Ohio. http://epa.ohio.gov/portals/35/documents/BioCrit15_Vol3.pdf
- Parker, C.R. 1998.** A review of *Goerita* (Trichoptera: Goeridae) with description of a new species. *Insecta Mundi* 12(3-4): 227-238.
- Peters, W.L. 1979.** Taxonomic status and phylogeny of *Habrophlebia* and *Habroleptoides* (Leptophlebiidae: Ephemeroptera), pp. 51–56. In: Paternak, K., and R. Sowa (eds.). Proceedings of the 2nd International Conference on Ephemeroptera. Panstwowe Wydawnictwo Naukowe, Warszawa-Krakow.
- Phillippi, M.A., and G.A. Schuster. 1987.** New records of caddisflies (Trichoptera) from Kentucky. *Entomological News* 98: 113-116.
- Randolph, R.P., and W.P. McCafferty. 1998.** Diversity and distribution of the mayflies (Ephemeroptera) of Illinois, Indiana, Kentucky, Michigan, Ohio, and Wisconsin. Ohio Biological Survey Bulletin New Series Volume 13 Number 1. Columbus, Ohio. vii + 188 p.
- Rasmussen, A.K., and J.C. Morse. 2018.** Distributional checklist of Nearctic Trichoptera (August 2018 Revision). Unpublished, Florida A&M University, Tallahassee. 506 p. <http://www.Trichoptera.org>
- Resh, V.H. 1976.** The biology and immature stages of the caddisfly genus *Ceraclea* in eastern North America (Trichoptera: Leptoceridae). *Annals of the Entomological Society of America* 69(6): 1039-1061.
- Roback, S.S. 1971.** The subfamily Tanypodinae in North America. Monographs of the Academy of Natural Sciences of Philadelphia, Number 17. 410 p.
- Sanderson, M.W. 1953-1954.** A revision of the Nearctic genera of Elmidae. *Journal of the Kansas Entomological Society* 26: 148-163; 27: 1-13.
- Spieth, H.T. 1938.** Two interesting mayfly nymphs with a description of a new species. *American Museum Novitates* 970: 1-7.
- Stahl, J.B. 1959.** The developmental history of the chironomid and *Chaoborus* faunas of Myers Lake. *Investigations of Indiana Lakes and Streams* 5: 47-102.
- Stahl, J.B. 1966.** Characteristics of a North American *Sergentia* lake. *Gewässer und Abwässer* 41/42: 95-112.
- Stahl, J.B. 1998.** Chironomid extirpation at Crooked Lake, Indiana. *Journal of the Kansas Entomological Society* 71(4): 383-387.
- Szczytko, S.W., and B.C. Kondratieff. 2015.** A review of the Eastern Nearctic Isoperlinae (Plecoptera: Perlodidae) with the description of twenty-two new species. Monographs of Illiesia 1: 1-289. http://Illiesia.speciesfile.org/illiesia/monographs/number_1.pdf
- Townes, H.K., Jr. 1945.** The Nearctic species of Tendipedini. *The American Midland Naturalist* 34(1): 1-206.
- Waltz, R.D., and W.P. McCafferty. 1983.** The caddisflies of Indiana (Insecta: Trichoptera). Purdue University Agricultural Experiment Station Bulletin 978: 1-25.
- Weaver, J.S., III. 1985.** A new species and new generic synonym of the Nearctic caddisfly genus *Homoplectra* (Trichoptera: Hydropsychidae). *Entomological News* 96(2): 71-77.
- Weaver, J.S., III, B.G. Swegman, and J.L. Sykora. 1979.** The description of immature forms of *Aphropsyche monticola* Flint (Trichoptera: Hydropsychidae). *Aquatic Insects* 1(3): 143-148.
- Webb, J.M., and S.K. Burian. 2017.** Range extensions for recently described North American species of *Acentrella* Bengtsson (Insecta: Ephemeroptera: Baetidae). *Check List* 13(3): 2132 (4 p.).
- Wiggins, G.B. 1996.** Larvae of the North American caddisfly genera (Trichoptera). Second edition. University of Toronto Press, Toronto, Canada. 457 p.
- Wiggins, G.B. 1998.** The caddisfly family Phryganeidae (Trichoptera). University of Toronto Press, Toronto, Canada. 306 p.